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going into the detail of manipulation with great care and thoroughness.

In Chapter II., dealing with sources of electricity, somewhat more space than is necessary seems to be given to primary batteries, since in this country at least such sources of current are seldom if ever found desirable. The use of the alternating-current supply is discouraged rather briefly (p. 42) when we consider that a motor-generator is known to be a very convenient and efficient method of deriving a low-voltage direct current from a higher-voltage alternating source.

A very important point in the design of contact breaks is emphatically presented (p. 66) and exceedingly well explained. It is very desirable that the duration of 'make' be long as compared with the time of 'break'; thus an interval is allowed long enough for the current to reach a maximum value before it is interrupted. Makers quite often pay too little attention to this, and writers frequently ignore it altogether.

The classification of breaks (p. 66) should, in the writer's opinion, include a fifth, viz., mechanical breaks. Such breaks have been used in this country with much success.

In the description of various tubes (Chap. 5), it is a cause of surprise and regret that one or two very effective American tubes are not mentioned. The automatic regulating tube invented by Sayen is used all over the United States and has been highly spoken of abroad by no less authorities than Lord Kelvin and Röntgen himself. The scope and plan of the book in general is such as to commend it to the writer as the best of the few that have yet appeared on the subject.

It should be a very valuable aid to all engaged in X-ray work who have not had much experience of their own, though, as the author clearly states, such personal experience is absolutely necessary to all who would produce reliable results.

Very little seems to be said in Mr. Eddyman's book about the use of X-ray methods in medical diagnosis, though that line has been considerably developed in this country. The results of investigators in all countries except in England seem to have been rather consistently overlooked.

ARTHUR W. GOODSPEED.

*Lehrbuch der Meteorologie.* Von DR. JULIUS HANN. Leipzig, Tauchnitz. 1901. Royal 8vo. Pp. xiv + 805. Pls. 8. Charts 15. Figs. 111.

That a text-book of meteorology from the hand of the leading meteorologist of the world would be a masterly presentation of the subject was a foregone conclusion. No one is better qualified than Dr. Hann to write such a book. As director of the Hohe Warte in Vienna; professor in the Universities of Vienna and of Graz; editor of the *Meteorologische Zeitschrift*; a life-long original investigator of the widest range of meteorological phenomena; an earnest student of meteorological publications in all languages, Dr. Hann has brought to his latest work a wonderfully rich experience and an amazing fund of knowledge.

The 'Lehrbuch der Meteorologie' is more than a text-book. It is rather a treatise on meteorology. It ranks as a worthy companion to the same author's 'Handbuch der Klimatologie.' The 'Lehrbuch' is not intended to be a 'popular' presentation for beginners, nor is it adapted for general reading. It is a systematic and concise review of the whole subject of meteorology, as complete as is possible within the limits of 800 pages. Nothing of any importance is omitted. Admirable brief historical summaries of the different topics are followed by references to the results of the most recent investigations. So many, so well selected, and so complete are the references, in text and footnotes, that the book is indispensable to every student of meteorology simply as a bibliography. In fact, teacher and student alike will want to have this volume always close at hand, on their desk, or on the nearest shelf of their bookcase.

Since Schmid published his classical 'Lehrbuch der Meteorologie,' in 1860, no author has attempted so complete a presentation of the subject as has been given by Dr. Hann. In its general plan the new 'Lehrbuch' is not unlike that of Schmid, allowing for the natural changes which have resulted from the advance of the science during the last forty years. Schmid's 'Lehrbuch' was a landmark in its time, and is so still, as a classic. Hann's 'Lehrbuch' now occupies, and will continue to occupy, a similar position. Schmid's book was overweighted

with tabular matter and with mathematical discussions. Dr. Hann has very wisely reduced his tabular matter to a minimum, and has devoted an appendix to the consideration of the more important physical theories which involve mathematical treatment. A few of the shorter and simpler formulæ only are included in the general text. By this arrangement the text is unencumbered, and the reading becomes easier and pleasanter. None of the modern text-books of meteorology, of which there are many, attempt to cover the field which Dr. Hann has so successfully covered. Hence no comparison of the new 'Lehrbuch' with these text-books is desirable, or even possible.

There is clearly no need to outline the contents of such a book as that now before us. Throughout, in the arrangement of the contents, the treatment of each subject, and the selection of the references, the hand of the master is clearly seen. If we were to single out one chapter which is likely to be of the most general interest to meteorologists at the present time, it would probably be that dealing with the theory of extra-tropical cyclones, a subject in the discussion of which Dr. Hann has taken a very prominent part, he being a strong advocate of the dynamic theory of the origin of these disturbances. In this country, Mr. H. H. Clayton, of Blue Hill Observatory, and Professor F. H. Bigelow, of the Weather Bureau, have made interesting contributions to this discussion. An excellent summary of the main facts in the case is given, and the position of the author is made clear by the statement (p. 586): "Es soll also hier die Ansicht vertreten werden, dass es zwar atmosphärische Störungen und damit Wirbelbildungen mannigfachen Ursprunges giebt, dass aber die Hauptursache derselben, namentlich aller grösseren und langlebigeren atmosphärischen Wirbel, in den Störungen der grossen atmosphärischen Zirkulation zu suchen sein dürfte."

Americans may well take satisfaction in noting the frequent references made by Dr. Hann to the work of Mr. H. H. Clayton and of his associates at Blue Hill Observatory, and also to that of the Weather Bureau. For a book of the size of this 'Lehrbuch' there are comparatively few illustrations in the way of charts and

weather maps. Since the publication of Bartholomew and Herbertson's new 'Atlas of Meteorology,' however, there is not much need of introducing charts into text-books of meteorology, especially when the books are of such a grade as the present one. There are four half-tone views of clouds; one of lightning; two of hail-stones, and one of a waterspout. This waterspout is the one which occurred off the southern coast of New England on August 19, 1896 (see SCIENCE, N. S., Vol. IV., 1896, p. 718). Isothermal, isanomalous, isobaric, wind and rainfall charts are included.

It is seldom that a reviewer has so pleasing a task as that involved in writing a notice of Hann's 'Lehrbuch der Meteorologie.' The book is a masterpiece.

R. DEC. WARD.

*A Manual of Determinative Bacteriology.* By F. D. CHESTER, Delaware College Agricultural Experiment Station. N. Y., The Macmillan Co. Price, \$2.60.

Systematic bacteriology is the *bête noir* of the bacteriologist. The amount of confusion which exists in literature regarding the description of species is hardly conceivable. The descriptions are found scattered through an extensive literature; they are sometimes verbose and extended, and at other times brief and insufficient. Anything which looks toward a simplification of this complex problem will always be received with relief by bacteriologists.

The work of Professor Chester is a somewhat modest attempt to give a little assistance in this realm of confusion. It does not pretend to be a study of systematic bacteriology, but rather, as the name indicates, of *determinative* bacteriology. The author has endeavored to collect all species of bacteria which have been sufficiently described for even moderately satisfactory determination, and to arrange these within the limits of one medium-sized book in such a way that they can easily be found. By the use of artificial analytical keys, based upon simple, but important characters, the bacteria which the author includes in his list have been classified into easily distinguishable groups.

The amount of labor which has been involved in the collection and tabulation of these numerous species, about 800 in all, is very great.